



**W&M ScholarWorks**

---

## Reports

---

1965

# Host-specificity of *D. vastator* and *D. solidus*

N. A. Izumova

Follow this and additional works at: <https://scholarworks.wm.edu/reports>



Part of the [Aquaculture and Fisheries Commons](#), [Marine Biology Commons](#), [Parasitology Commons](#), and the [Zoology Commons](#)

---

## Recommended Citation

Izumova, N. A. (1965) Host-specificity of *D. vastator* and *D. solidus*. Translation Series. Virginia Institute of Marine Science, College of William and Mary. <https://scholarworks.wm.edu/reports/49>

This Report is brought to you for free and open access by W&M ScholarWorks. It has been accepted for inclusion in Reports by an authorized administrator of W&M ScholarWorks. For more information, please contact [scholarworks@wm.edu](mailto:scholarworks@wm.edu).

VIMS  
DH  
301  
.T73  
no. 14  
C.3

HOST-SPECIFICITY OF D. VASTATOR AND D. SOLIDUS

by

N. A. Izumova

Edited

by

William J. Hargis, Jr.

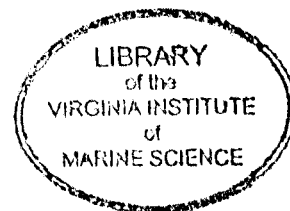
Translated

by

Pierre C. Oustinoff

TRANSLATION SERIES No. 14

VIRGINIA INSTITUTE OF MARINE SCIENCE  
Gloucester Point, Virginia  
1965



Preface  
to Translation<sup>1</sup>

Translation of this paper was undertaken as part of a long-term research project on the systematics, host-specificity and zoogeography of monogenetic trematodes.<sup>2</sup> Translation and editing were accomplished in the following manner:

1. Oustinoff<sup>3</sup> read translation on tape.
2. Mrs. Morales transcribed translation from tape to first typescript.
3. H argis edited typescript.
4. Typescript retyped by Mrs. Morales.
5. H argis again edited typescript for final corrections.

A conscious effort has been made to keep this translation as near the original as possible. It is probably inevitable, however, that some of the nuances of meaning in the original have been distorted or lost. For this we apologize to the author and the reader.

Certain passages were difficult to translate. Where a different English phrase seems to fit the author's meaning better or serves to clarify the text, it has been inserted in brackets. Certain obvious errors or misspellings in the original text were changed, less obvious ones are noted with (sic).

For convenience in referring to the Russian text the original pagination is given in the margin of the translation opposite the place where the new page begins. Occasionally figures or tables are somewhat displaced from their original page location; however, since they, themselves, are numbered sequentially no confusion should result.

This translation is intended as a service to researchers. Though effort has been made to make it comprehensible, accurate and useful, it is likely that improvements can be made. Should literary improvements or verification appear desirable it is suggested that the researcher make his own translation. Pagination is arranged to facilitate such activity. We will appreciate constructive suggestions for improvements in this and future translations.

Thanks are due to Mrs. Patricia C. Morales of the Virginia Institute of Marine Science who transcribed, typed and assembled the manuscript, and to Miss Evelyn Wells who assisted with final editing.

William J. Hargis, Jr.

---

<sup>1</sup>Virginia Institute of Marine Science Translation Series No., 14.

<sup>2</sup>Translation and editing supported by funds from Grant No. E-2389 of the National Institutes of Health.

<sup>3</sup>Chairman, Department of Modern Languages, College of William and Mary, Williamsburg, Virginia.

HOST-SPECIFICITY OF D. VASTATOR AND D. SOLIDUS

N. A. Izumova

Zoological Institute of the Academy of Sciences USSR

The problem of the specificity of parasites is a most important biological question--one with great theoretical and practical significance. Recently many researchers have focused attention on it. However, it should be noted that the majority, while limiting themselves by stating the fact of specificity, or more precisely, the fact of occurrence of specific species of parasites on their hosts, attempt to explain this occurrence without including experimental data. Practical problems facing the fish industry demand clarification of concrete questions connected with specificity of parasites of fishes to their hosts and the reasons for this phenomenon. Different authors interpret specificity differently. Without stopping to elaborate on the definition of specificity we shall indicate that by specificity we mean the ability of parasitic organisms to adapt themselves to a specific group of hosts.

The project at hand was confined to an attempt at clarification of the nature of the relationship of only two species of Dactylogyrus, D. vastator and D. solidus, to their hosts as well as of the factors which govern this relationship. In our opinion, clarification of these factors will aid considerably in developing a fuller and more comprehensive understanding of this complex biological phenomenon and assist in solving a number of important practical problems.

Academician E. N. Pavlovsky (1946) emphasized that the relationship between hosts and their parasites is determined by three basic factors: ecological, morphological and physiological. According to E. N. Pavlovsky, the ecological factor provides for the establishment of biocoenotic links, alimentary or some other type, between the potential hosts and parasites which favor the encounters between adult parasites, themselves, or between the different stages in their development and the hosts. The morphological factors, according to E. N. Pavlovsky, are those involving the structure of the host organism which enables the parasites to gain entrance to and to attach themselves on the host. The physiological factor is the nature of the biochemistry of the host organism which not only makes possible the survival of parasites in the new medium or habitat, but allows subsequent completion of the parasite's life cycle on that host. In every specific case one must decide which of these factors or combinations thereof are the controlling ones.

According to the literature in many cases the distribution of monogenetic trematodes represent excellent examples of strict specificity of separate species of parasites to determine species of fishes. It is known that D. solidus a dangerous parasite of Sazan, and carp, is encountered only on these fishes and has not been found on Goldfish (Carassius) which are closely related to them. Another parasite of carp, D. vastator, which often causes mass deaths of carp fry in fish ponds, is encountered both on Carassius and carp. Dactylogyrus vastator /populations/ from Carassius and Carp do not differ from each other morphologically (Bychowsky, 1933). p218

The manual of instructions pertaining to fish pond culture (1949), a reference book for fish breeders, recommends the rearing of carp and goldfish together, stressing that in doing so the productivity of carp is increased 50 to 70% without causing any loss of weight in the fish. Accompanying these instructions are references to numerous cases of combined rearing of carp and Carassius in the same pond. Despite this, contradictory opinions of parasitologists concerning the /strong/ possibility of transfer of D. vastator from Carassius to carp and vice versa /under these conditions/ obviously contradicts the combined breeding of these fishes in the same fish pond creating a dilemma for the fish culturists. They /the fish breeders/ and the fish culturists ask the parasitologists the legitimate questions: What should be done? Should Carassius be kept in the same pond with carp or should the two types of fishes be kept strictly apart?

In order to answer these and other questions pertaining to specificity of dactylogyrids, we conducted experiments limits to the two species of monogenetic trematodes, D. vastator and D. solidus. The aims of this study included attempts to clarify the following:

1. The degree of conditioning of D. vastator to carp and Carassius. In this phase of the study it was necessary to determine the possibility of transfer of D. vastator from carp to Carassius and vice versa.
2. The nature of interrelations of D. solidus between carp and Carassius and the possibility of its transfer /from carp/ to Carassius.
3. The possibility of transfer of D. vastator and D. solidus both in natural and artificial conditions from carp to other pond fishes, chiefly to Tinca tinca and Leuciscus idus, as potential hosts of these species of Dactylogyrus.

We shall not redescribe the methods employed since they have already been published (Izumova, 1953).

#### Degree of Conditioning of D. vastator to Carp and Carassius

Only a small number of D. vastator from Carassius were available because the Carassius of "Ropsha" and "Gostilitza" /fish ponds or fish rearing establishments/ where this work was conducted were free of these parasites. One hundred

and sixty-eight specimens of yellow or golden Carassius and 241 of white or silvery Carassius from these fish ponds were examined and not one D. vastator was discovered. /Though the author distinguishes varieties here he does not elsewhere in the paper./ A small quantity of worms was found on Carassius in only one of the ponds of the Biological Institute LGU /Leningrad State University/--the old Peterhof. Among the 300 Carassius from Peterhof only 29 had D. vastator in quantities varying from 2 to 4 individuals /per fish/. It should be noted that during /the period encompassing/ B. E. Bychowsky's work (1931-1933) in Peterhof large quantities of dactylogyrids, including D. vastator, occurred on the gills of Carassius caught in the same pond. It is difficult to say what caused this sharp change in the infection of Carassius; however, it is a very interesting fact and undoubtedly deserves attention. Large numbers of D. vastator were recovered from carp.

A series of experiments were arranged to clarify the degree of conditioning of D. vastator to carp and Carassius.

EXPERIMENT 1. Free-swimming larvae were obtained from eggs of D. vastator from Carassius. Sterile young carp measuring 2.4 - 2.5 cm were placed in the containers with the larvae. Thirty-seven small carp were used in the experiment. Autopsies performed 10 days after infection showed that only seven (7) out of 37, that is 19% had two (2) to three (3) adult D. vastator. The remaining small fish were free of Dactylogyrus. p219

Since we did not have a sufficient quantity of eggs of D. vastator from Carassius to control this experiment we exposed sterile carp fry (of 2.1 - 2.8 cm in length) to larvae of D. vastator obtained from the carp. Fifty fry were used in the experiment, of these 35 (70%) were infected by D. vastator. From eight (8) to 20 samples of worms were found on each infected small fry. This experiment showed that where close contact exists between larval parasites and hosts--fry, infection of carp by the larvae of D. vastator from Carassius will occur, but that the degree of this infection is limited.

Only one small carp /potential host/ was placed with considerable quantities of larvae of D. vastator from Carassius in each container. Such limitation in the infection of the small carp (19%) despite the close contact between the larvae of the parasites and the fry, leads us to suppose that there are certain physiological differences between carp and Carassius and that these differences determine the degree of infection. However, these differences are so negligible that they can only limit the degree of but not prevent the infection of fishes.

It is impossible to establish the degree of conditioning of a parasite to its host only from /data concerning/ one generation of parasite. Naturally the question of what would be the relation of the second generation of parasites to its new host arose. Another experiment was conducted in order to answer this.

EXPERIMENT 2. Eggs and their free-swimming larvae were obtained from the Carassius from D. vastator which had lived on the gills of carp from the larval to adult stages. Ten sterile carp fry were exposed to them. Autopsy opening on 10th day /following exposure/ showed that four (4) out of 10, that is 40%, of the fry bore one (1) to two (2) samples of adult D. vastator on their gills. Unfortunately, this experiment could not be conducted in the desired scope, because the quantity of eggs obtained from the worms of the first and the second generation was not sufficient.

Both experiments showed that under favorable conditions D. vastator from Carassius can and do transfer to the carp. However, the small number of eggs deposited by these dactylogyrids which had spent two generations on the gills of the carp reconfirms that certain changes take place in the parasite /and the host/ when a parasite invades and lives in a new /"foreign" or "unnatural"/ host.

With the large quantity of D. vastator from carp at our disposal we conducted experiments to clarify the possibility of transfer of this form to Carassius. Carassius of different ages--fry, one-year-olds, two-year-olds--were used for this experiment.

EXPERIMENT 3. Forty-four Carassius fry, 2.0 to 2.9 cm long, were exposed to free-swimming larvae of D. vastator from carp. Autopsies 10 days later indicated that 10 of them, that is 22.7%, bore from three (3) to five (5) mature D. vastator.

Along with the fry, 32 one-year-old Carassius, 8.6 - 13.4 cm long, were exposed in small transparent containers. On autopsy 11 days later after infection only six (6) (18.1%) of them bore two (2) to four (4) samples of adult D. vastator on their gills.

As a control for this experiment, one-year-old carp, 5.1 - 10.8 cm long, p220 were exposed by larvae obtained from the eggs of D. vastator from carp. Fourteen (14) of the 15 carp (93.3%) used in this experiment were infected by 10 to 13 individuals /per fish/.

Thus, this experiment showed that: (1) Carassius can be and are infected by D. vastator from carp; and (2) the number of Carassius infected and the quantity of worms on their gills in the experimental groups is considerably smaller than those in the control animals, i.e. the carp. Also, larval D. vastator infect not only fry but also those whose lengths may exceed five (5) centimeters considerably. This contraindicates an age immunity in connection with D. vastator despite insistence to the contrary by Groben, Spikhakov and Liaiman.

Supplementary experiments were performed in order to solve definitively the problem of the nature of interrelations between D. vastator from carp and the carp themselves as well as with Carassius.

EXPERIMENT 4. Limitations in the infection of Carassius by free-swimming larvae of D. vastator forced us to adopt another method of infection, specifically that of transferring adult D. vastator with /and on/ the gill of the carp to the internal surfaces of the operculae of the Carassius. Gills of the carp with large quantities of adult worms were /surgically/ attached to 30, one-year-old Carassius of 7.1 - 12.6 cm in length. Autopsies carried out six (6) to seven (7) days after the operation showed that D. vastator to be on 14 Carassius (46.6%). Interestingly the number of worms on one fish did not exceed eight (8) individuals even though there were not less than 20 on each of the gills transferred from the carp. In all probability, a considerable part of the worms perished and was carried away by currents of water at the moment of transfer from the gill of the carp to those of the Carassius. The results were somewhat different when this experiment was altered.

A single operculum was removed from each of 13 Carassius. (This operation was very easily borne by the Carassius.) Obviously, in removing the operculum from the experimental gill chamber unusual conditions were created from the parasites. As we had planned, the excised, worm-bearing gills of the carp were attached to the gill arches of the Carassius either between the first or the second, or between the second and third, or between the third and fourth gill arches. Autopsies showed that D. vastator transferred to the gills of only five (5) out of 13 Carassius /38.4%/. Also, their spatial distribution was different from normal. They had transferred either from the ends of the gill filaments to their bases or to the gill rakers and spaces between them. A few individuals were found on the gills of the other, operculate side. Just how this transfer of trematodes from the gills of one side to the gills of the other side took place was not quite clear, but it did. Such unusual location of D. vastator (on the base of the gill filaments and gill rakers) suggests that the force and the direction of the streams of water which influence the spatial distribution of the worms were changed with the removal of one gill operculum.

Apparently in transferring adult D. vastator from carp to Carassius /in this fashion/, the percentage of infection of the latter increased up to 46.6%, which considerably exceeded the percentage of infection of Carassius by free-swimming larvae (18.1 and 22%). The ability of free-swimming larvae of D. vastator to attach to the gills of fishes is apparently more limited than attachment by adult forms.

Further experiments to solve this problem were conducted but only on small fry.

EXPERIMENT 5. Because we were interested in ascertaining the ability of D. vastator from carp to infect both carp and Carassius, eggs and from them larvae were obtained from adult trematodes from carp, and 76 Carassius and 50 carp were exposed to these larvae. When the fish were examined 11 days later 18 to 22% Carassius and 70 to 93% carp were infected. p221

Further, larvae were again obtained from the mature D. vastator from carp which developed from larvae to adult forms on Carassius and exposed to 20 specimens of Carassius and as many carp. Autopsy of these experimental hosts



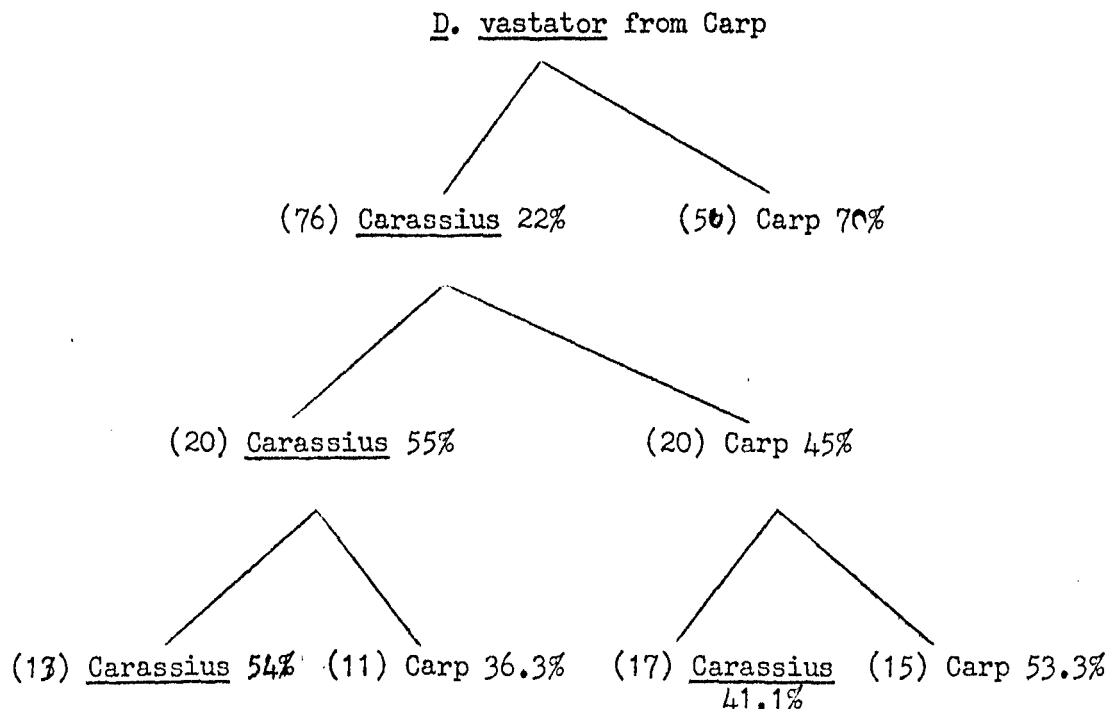
showed that exposure of the trematodes from carp to Carassius /rearing them to maturity on Carassius/ had a definite effect on their heredity, as a result of which /their ability to infect/ infection of Carassius increased considerably (55%) whereas /their ability to infect/ infection of carp became weaker (45%).

Infection experiments were continued. Larvae were obtained from eggs deposited by carp D. vastator which had lived for two generations on Carassius and used to expose 13 Carassius and 11 carp. On autopsy it was found that the percentage of infection of Carassius remained approximately the same as in the preceding experiment--54%, while the percentage of infection of carp decreased to 36.3%. These data indicate that D. vastator from carp which have been reared on Carassius become more "carassian" than "carp" even by the third generation.

Finally, larvae from D. vastator from carp, which had lived one generation on Carassius (22% infection, see diagram) and one /generation/ on carp (45% infection) were obtained and exposed to 17 Carassius and 15 carp. Autopsy indicated that Carassius as well as carp are rather well infected by larvae with this history (Carassius 41.1%, carp 53.3%).

To all appearances, the data of the last infection demonstrate the result of the loosening of the heredity of the worms, which occurred during transfer of infections of Carassius and carp. The general course of the experiment is shown in the diagram.

Diagram of Experiment No. 5



The number in parenthesis to the left of the name of the fish designates the number of fishes exposed. The number to the right indicates the percentage of fishes infected.

This experiment strongly substantiated the data of the preceding experiments which established the possibility of transfer of D. vastator from Carassius onto the carp and vice versa. Fish pond industry workers must keep this in mind whenever mixed rearing of fish occurs. One more experiment was decided upon to solve the problem of the possibility of transfer of D. vastator from carps onto Carassius under natural conditions. p222

EXPERIMENT 6. Fourteen sterile Carassius fry (2.9 - 3.2 cm long) were placed into an aquarium having a capacity of five liters with 6 carp fry (3.2 - 3.5 cm long) which were heavily infected by D. vastator. The water in the aquarium was not changed. Autopsy of the Carassius fry after 18 to 20 days following exposure indicated that four (4) out of 14 small Carassius (28.5%) bore from two (2) to 13 samples of D. vastator on their gills. Both larval and adult worms were present.

This experiment strongly reconfirmed the data of our previous experiments and showed that healthy young Carassius fry become infected when there is contact between them and infected carp fry.

The results of Bauer's experiments (1951), which were, as he wrote, of a preliminary nature, are essentially contrary to ours. The negative results obtained by him in his experiments during cross-infection of Carassius and carp by D. vastator apparently result from the nature of his research methods. Bauer used Dactylogyrus eggs to expose his fishes and was unable to secure infections. Obviously, with this technique there was no certainty that a large /an adequate/ number of larvae of Dactylogyrus even developed in the aquarium. It is possible that many perished /either in the egg or after hatching/, and that the numbers of surviving larvae were insufficient to infect the fishes. Only when the experimenter sees a mass of swimming Dactylogyrus larvae in a container and immerses the fishes to be infected into this mass can he be certain of the data obtained as the result of his experiments.

In summary, it seems evident that: 1) there is no strict specificity /physiological specificity--W.J.H.Jr./ of D. vastator to carp and Carassius; 2) transfer of D. vastator from carps to Carassius and vice versa is possible. Consequently, Carassius can serve as a source of infection of carp by D. vastator in fish pond conditions.

A number of circumstances must be considered in order to answer practical workers on the question of joint rearing of carp and Carassius. If one has one-year-old carp infected by D. vastator in a fish pond, and if the Carassius /in another pond/ are free from parasites, then, despite the ecological isolation of these two species (Carassius and carp, as a rule, occupy different ecological niches), joint transfer of /these populations of/ Carassius and carp to other ponds for further development is inadmissible. This is because within the confines of a single pond there may be common points of contact between infected carp and uninfected Carassius, i.e., the back waters of the pond, the feeding trough /an apparatus used to feed the fishes/, and other /places/. /In order to avoid trouble most easily/ it would be simpler and more positive to forbid

categorically the holding of carp and Carassius in the same fish ponds, however, it would hardly be correct to proceed by this route.

One must always remember, that joint rearing of a culture in the same ponds /often/ increases production of fish considerably thus justifying common rearing of fishes in ponds. Consequently, the question of whether Carassius should be reared with carp or whether they should be strictly isolated should be resolved separately for each specific case. The role of parasitologists and p223 sanitarians /Health Dept./, who are called to make a systematic control of parasites and to ascertain the condition of fishes in fish industries is important to these activities. As an example, in cases when Carassius in the pond are not infected by D. vastator and when the infection of carp by this form is not great, joint rearing of carp and Carassius is quite possible under the conditions pertaining in the fattening ponds /ponds to which fish are transferred from fish breeding ponds when they are young, the "fattening" ponds are the ponds where the fish matures/ in which there is considerable space. But under the /more confined/ conditions of breeding ponds coexistence of Carassius and one-year-old carp (when D. vastator is present on the carp) is extremely undesirable.

In this connection we should remember the Carassius in the fish pond /farm/ "Ropsha" where this research was conducted. Carassius of this fish pond were not infected by D. vastator while many of the small carp were considerably infected. It may be asked, Why, despite the presence of infected carp, the Carassius remain uninfected, and why, considering the conditions of this fish pond, is it possible to rear Carassius together with carp?

Analysis of knowledge of the dynamics of infection of fishes in this fish pond /farm/ permits us to conclude that D. vastator are absent from the gills of Carassius because here the Carassius are reared together with carp only in the feeding ponds and only with certain age groups of carp--two-year-olds and breeders which as a rule are weakly infected by D. vastator. Development of Carassius in spawning ponds and ponds where the fish mature together with fry and one-year-old fish, which are heavily infected by D. vastator is not practiced in this industry. Thus, because of the lack of contact between the Carassius and infected carp fry and one-year-old carp, and also as result of keeping them in fattening ponds where large areas create unfavorable conditions for contact between the larval dactylogyrids and the fishes, the Carassius of this fish pond /farm - Ropsha/ are free from D. vastator. In connection with this it is quite possible and useful for their joint rearing in fattening ponds together with two-year-olds and the breeders

Interrelations between D. solidus and carp and Carassius  
and the possibility of its transfer to the latter.

In recent years parasitological studies of fishes of the Far East have shown that there is still a rather large number of species of Dactylogyrus not known to science. From those studies it was learned that Dactylogyrus solidus is a dangerous parasite of Sazan /Cyprinus carpio in Dumbleton/ /carp family/. As was shown by subsequent research it is widely distributed, not only in the Far East but also in a number of basins of the European part of the Soviet Union. During recent years it has been learned that it is encountered rather often on Sazans of the Volga and Danube Rivers. Dactylogyrus solidus has become one of the basic species in a number of fish ponds in the European part of the USSR and represents a threat to the successful breeding of carp.

In spite of the fact that the description of D. solidus by Akhmerov dates back to 1948, a number of questions pertaining to biology and pathogeny of this species remain unanswered. Even though it is of considerable interest, Bauer's work (1951) appears to be an introductory study. A number of questions on the biology and especially the specificity of this species remains unanswered. Considerable painstaking work is needed on comprehensive study of the biology, pathogeny and specificity of D. solidus, in order to help practical workers to organize properly the struggle against it. p2

The purpose of this research was a clarification of the nature of interrelations of D. solidus with carp and Carassius, or more correctly, a clarification of the possibility of its transfer to Carassius. /It is known/ that there are no sharp differences in the structure and function of the gills of Carassius and carp.

The occurrence of D. vastator on both carp and Carassius and the possibility of cross infection of fishes by this species affirms that two of the three factors determining the specificity of parasites to their hosts mentioned by E. N. Pavlovskii--morphological and physiological--were excluded in the present case. Naturally, the question arose as to why D. solidus is encountered only on the gills of the carp in natural bodies of water as well as in fish ponds where both Carassius and carp are present. It has been thought that D. solidus is not found on the gills of Carassius because of the ecological isolation of carp and Carassius under the conditions existing in the same bodies of water. However, if conditions are created under which the contact between the larvae of D. solidus and Carassius is insured then the infection of the latter is quite possible. For clarification of this question appropriate experiments with Carassius were conducted.

It should be noted that a number of technical difficulties were encountered in carrying out these experiments. After a number of failures experiments in aquaria had to be abandoned because insufficiency of oxygen in the aquarium was such that D. solidus individuals were distressed even on the

gills of their normal hosts--carp. It seemed quite natural that transfer of adult D. solidus individuals to the gills of hosts--Carassius, which were unusual /"foreign/" to them would not be likely to take place under these conditions. As a result, it was decided to transfer the experimental fishes to be infected by adult forms of D. solidus to a live box or breeding chamber in a pond. (Under these conditions infection of Carassius took place by both larval and adult individuals.)

EXPERIMENT 7. In this experiment we attempted to infect sterile Carassius fry with free-swimming larvae of D. solidus. Experiment was carried out in small containers. We believe that the experiment is possible only if there are no less than 20 to 30 larval D. solidus in the container where the infection of one Carassius fry is to be attempted. The difficulty of obtaining a large quantity of D. solidus larvae during the summer did not permit us to conduct this series of tests on the scale desired.

Only 11 Carassius fry, whose sizes varied from 1.9 to 2.6 cm, were exposed to the larvae of D. solidus. Autopsy of exposed fry was carried at different periods of time. One was opened 12 hours after infection and one (1) larva of D. solidus was found on the mucous membrane of the oral cavity in the region of the jawbone. Two small fry were opened 24 hours after exposure and no larvae were found. Of three fry autopsied two days after infection 2 were not infected while 5 larvae were found on the third. Three of the 5 larvae were located in the middle part of the gill filament and the other 2 were attached to the gill arch between the gill rakers.

Of the 3 fry opened three days after exposure 2 were free of larval Dactylogyrus, but 1 was found on the gill filaments of the third. Two fry opened five days after exposure bore no larval dactylogyrids. Thus, larvae were discovered only on 3 out of 11 /27.2%/ experimental fry.

p225

It was hardly possible to draw any conclusions from such an experiment. The occurrence of 5 larvae of D. solidus on 1 of the experimental Carassius fry two days after infection and of one on the gills of a fry on the third day allowed us only to conclude that the free-swimming larvae can attach themselves and begin their development on the gills of Carassius. The lack of larvae of D. solidus on the gills of Carassius autopsied five days after infection can be interpreted differently. On the one hand, it is possible that for certain reasons, possibly of physiological nature, the larvae cannot live on the gills of Carassius more than three days. On the other hand it is possible that an insufficient quantity of experimental material was used.

EXPERIMENT 8. This experiment was intended to clarify the possibility of transfer of D. solidus to the gills of Carassius. For this experiment we utilized the method of sewing trematode-bearing gills of the carp to the insides of the operculae of Carassius. Ninety-three Carassius, one-year-old and from 6.5 - 13.5 cm long, were placed in the live box established in the pond. Autopsies were made from 2 to 12 days after attachment of carp gills. The results of the experiment are presented in Table 1.

TABLE 1. Results of Exposure of D. solidus  
to the gills of Carassius.

Duration of Study in 24 hr. periods	Number of <u>Carassius</u> employed.	Number of infected <u>Carassius</u>	Number of <u>D. solidus</u> on their gills
2	17	3	3 - 5
3	17	5	2 - 4
4	13	1	3
6	14	2	1 - 3
7	8	0	-
8	11	0	-
11	6	2	2 - 6
12	7	1	2
	93	14	

This experiment established that adult D. solidus may transfer from the gills of carp to the gills of Carassius and attach there. Observations showed that they did not stop feeding and depositing eggs. It was found that the location of the worms on gill filaments of Carassius is the same as it is on the gills of the carp, that is, in the middle section of the filaments. However, as is apparent from Table 1 the number of worms which attached themselves to the gills of Carassius was always small. It is possible that this was connected with the death of a part of the worms at the moment of transition from the gills of the carp to the gills of Carassius. Moreover, during autopsy it was noted that almost all the worms occupied the periphery of the gills of Carassius, mainly their ventral more aerated section. This fact indicated that D. solidus does not always feel well at new location. /Unfortunately, the author does not mention the fate of the surgically attached carp gill tissue which might have rotted to produce low oxygen levels or other unfavorable conditions in the gill chamber. WJHJr./

In any consideration of the results of the above-mentioned experiments we wondered whether we were dealing with temporary survival of the trematodes on Carassius gills or whether their transfer to and attachment there would last for a considerable time. If it was simple survival on the gills of new hosts then one would have hardly have expected the discovery of D. solidus on Carassius 11 to 12 days after the infection. Thus, we concluded that under conditions of close contact with the potential host, adult and larval D. solidus could transfer to the gills of Carassius and live there. This supposition, of course, demands p226 very careful verification and further experiments.

If this is so, why do we not encounter Carassius infected by D. solidus in natural conditions? We can only answer this question hypothetically. If one excludes morphological and physiological factors which may impede the infection of Carassius by D. solidus there remain the ecological factors which in many cases determine the specificity of particular species of parasites to their hosts. It is possible, however, that here the greater role is played, not by the factor of the ecological isolation of the two fishes, but by biological peculiarities of the worms themselves, peculiarities connected with their specific reactions to the oxygen and temperature regimes of the body of water in which they /and the host/ occur /the macroenvironment/. In spite of the fact that under identical conditions and in the same pond Carassius and carp occupy different ecological niches, there are common places where contact might occur. In shallow waters, the well-heated back waters of the pond, where carp and Carassius may be encountered together, a certain quantity of eggs of D. solidus may accumulate. However, their development is hampered by the unfavorable (too high) temperature and the unsuitable oxygen regime of these reservoirs.

One might also conjecture, that in certain cases infection of Carassius by the larvae of D. solidus in natural conditions does occur (not because D. solidus cannot infect Carassius) but because of the biological peculiarities of these fishes living as they often do among decomposing vegetable remnants, in the zone of oxygen deficiency, the specimens of D. solidus which came upon them by chance perish.

Thus, the peculiar biology of D. solidus, on one hand, and the ecological peculiarities of Carassius on the other hand, makes infection of Carassius by D. solidus impossible. Because of this, one may consider for practical purposes that D. solidus cannot transfer to Carassius and cannot represent a threat to the fish pond industry from this point of view.

Possibility of transfer of D. solidus from carp  
to Leuciscus idus and Tinca tinca.

The plan of research was to determine whether the dactylogyrids parasitizing carp, mainly D. vastator and D. solidus could transfer to the gills of Leuciscus idus and Tinca tinca.

The determination of potential hosts for these species is of considerable practical significance to the fish industry. For a number of technical reasons we could not carry out experiments with D. vastator and, as a result, only D. solidus was used. The following is a brief presentation of the results of these experiments.

EXPERIMENTS WITH Tinca tinca. In many fish ponds Tinca tinca are reared with carp. Consequently, our problem was to determine whether D. solidus could transfer to the gills of Tinca tinca. Experiments were conducted with fry as well as adult tench, Tinca tinca.

Nine (9) Tinca tinca, 2.8 - 3.1 cm long, were exposed to free-swimming larvae of D. solidus. Autopsies conducted after one, two and three days, revealed a total absence of larvae of dactylogyrids on their gills. Thirty-five Tinca tinca, 7 - 9 cm long, were exposed to adult individuals by means of attachment of parasite-bearing carp to the insides of the operculae of the tench. Autopsy of Tinca tinca conducted after three, four and five days showed that the adult forms of D. solidus did not transfer /or did not survive after temporary transfer/ to the gills of these fishes.

These negative results in the experiments with Tinca tinca can be explained by the peculiarities of the biology of Tinca tinca. First, their benthic way of life is reflected in the structure and mechanism of action of their gill apparatus to a considerable degree. Secondly, Tinca tinca has certain physiological peculiarities. One may suppose that their ability to bury themselves in silt and survive under the conditions of acute oxygen deficiencies, under which the other fishes would perish, is correspondingly reflected in their physiology which differs significantly from that of the carp. Consequently, D. solidus cannot attach themselves to the gills of Tinca tinca and feed on their blood. In the third place, the biological requirements of D. solidus, itself, might prevent its establishment on this host. p22'

Thus, we can conclude that D. solidus presents no danger for Tinca tinca bred in carp fish industries.

EXPERIMENTS WITH Leuciscus idus. The "Golden Yaz" /of the fish industry/ is an exclusive domesticated form not encountered in nature. It is a variety of the ordinary Leuciscus idus devoid of black pigments which has been bred mainly as a decorative fish. However, under favorable conditions it can become a very valuable food fish. As is known, many fish industries rear Leuciscus idus together with carp. It was necessary to conduct experiments with Leuciscus idus in order to find out whether there was a possibility of it being infected by D. solidus. The experiments were conducted only with adult worms (because of the difficulty in obtaining large quantities of larvae of D. solidus there were no experiments utilizing larvae) using the technique of surgically attaching the gills of infected carp inside the operculum of Leuciscus idus. The duration of the experiments was from 2 to 11 days. Results of the experiment are presented in Table 2.

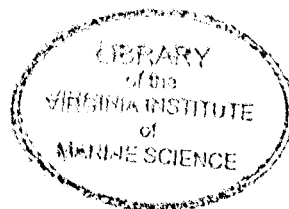




TABLE 2. Results of exposure of D. solidus to the gills of Leuciscus idus.

Duration of Experiment in 24-hour periods	Number of <u>Leuciscus idus</u> employed	Number of infected <u>Leuciscus idus</u>	Number of <u>D. solidus</u> on their gills
2	12	1	1
3	8	2	1 - 2
4	8	7	2 - 3
6	14	0	0
7	9	0	0
11	8	0	0
	59	10	

From Table 2 it is apparent that the mature D. solidus transferred to the gills of Leuciscus idus where they attached to the middle section of the gill filaments and fed on the hosts' gill epithelium and blood. However, under the conditions of the experiment (the experiment lasted 11 days), D. solidus did not live more than 4 days on the gills of Leuciscus idus. Consequently, it seems to us that the finding of D. solidus on the gills of the Golden Y<sub>az</sub> can be viewed only as a temporary experience of the worms. Therefore, joint rearing of Leuciscus idus and carp under the conditions of fish industries is quite permissible.

In summary of this section we may conclude that D. solidus is a narrowly specialized monogeneid and does not offer any danger for Leuciscus idus, Tinca tinca and even Carassius bred in carp fish ponds.

The question of specificity of monogenetic trematodes for their hosts is of great practical significance. However, comprehensive studies of specificity are possible only with elaborate research. In this connection, it is particularly important to include biochemical analysis among the techniques in studies of the specificity of different parasites for their hosts. Unfortunately, to this time most parasitologists have utilized only morphological and ecological factors, and everything which did not fit into a rubric of these factors has been very often attributed a priori to those physiological factors which, so to speak, are determining in a given case. As a rule data of biochemical analysis /experiments/ are not cited. It is quite likely that those factors governing specificity which we so readily and facetiously term "physiological factors" /without going any deeper/ are in reality specific, subsidiary physiological /and ecological/ requirements and responses /of both the host and parasite/

which may be interdependent in an intricate and complex fashion. Consequently, it is very important to clarify more accurately and precisely what determines specificity of the parasite to its host in each specific case. In doing so, one should not forget about the morphobiological peculiarities of the parasites themselves.

## BIBLIOGRAPHY

- Akhmerov, A. Kh. 1948. New species of monogenetic trematode from the gills of Amurean Sazan and the area of its distribution. News of All-Union Scientific Research Institute of the Fish Industry of Lakes and Rivers, 27: 232-234.
- Akhmerov, A. Kh. 1952. New species of monogenetic trematode of Amur River fishes. Parasitological Collection of the ZIN Academy of Sciences USSR, 14: 181-212.
- Bauer, O. N. 1951. On the question of pathogeny of Dactylogyrus solidus Akhmerov. DAN U.S.S.R. 78 (4): 825-827.
- Bykovskii, B. E. 1933. Notes on monogenetic trematodes of the genus Dactylogyrus Diesing of the Carassius of the Park Reservation of the Biological Institute of Peterhof. Works of Leningrad Society of Naturalists, 62 (3): 269-296.
- Izumova, N. A. 1953. Materials on method of study of specificity of monogenetic trematodes. Works of ZIN Academy of Sciences of USSR, 13: 155-158.
- Knorre, A. P. 1936. Distribution of parasites in the animal kingdom. Scientific Notes of LGU Leningrad State University/ 3 (4): 21-28
- Knorre, A. P. 1937. Distribution of parasites in their hosts and the problem of specificity. Scientific Notes of LGU Leningrad State University/ 3 (4): 108-118.
- Pavlovskii, E. N. 1934. Organism as medium of habitat. Nature 1: 80-90.
- Pavlovskii, E. N. 1937. On biocoensis /literally teaching about biocoensis/. News Academy of Sciences USSR, Series on Biology 4: 1386-1422.
- Pavlovskii, E. N. 1946. Conditions and factors of establishment of the organism by the host of the parasite in the process of evolution. Zoological Journal 15 (4): 289-304